1.9
P69P

Dr. L...

LIBRARY
RECEIVED
★ JUL 6 1931 ★
U. S. Department of Agriculture

THE PLANT DISEASE REPORTER

Issued By

Division of Mycology and Disease Survey

Volume XV Number 7

July 1, 1931

BUREAU OF PLANT INDUSTRY

UNITED STATES DEPARTMENT OF AGRICULTURE

THE PLANT DISEASE REPORTER

Issued by

THE PLANT DISEASE SURVEY

OFFICE OF MYCOLOGY AND DISEASE SURVEY

Vol. XV July 1, 1931 Number 7

VEGETABLE DISEASES

VEGETABLE DISEASE SURVEY IN NEW YORK

By Charles Chupp

CABBAGE: On June 8 I made a survey of a rather large number of cabbage seed beds in Ontario County. Most of the seed had been treated with hot water. No black leg (Phoma lingam) nor black rot (Bacterium campestre) was seen even in seed beds where both of these diseases appeared rather abundantly during 1930. Damping-off and wire stem (Corticium vagum) were relatively common, especially where the plants were grown under cheesecloth. Injury ranged from a trace to 25 per cent, with an average of probably 7 or 8 per cent.

PEAS: On June 9 and 10, in company with Dr. James Horsfall of the Geneva Agricultural Experiment Station and Dr. Geise of the American Can Company, I examined pea fields in Ontario, Yates, Livingston, Onondaga, Madison, and Cortland Counties. In nearly all fields there was a reduction of stand due apparently to planting just before or just after very heavy rainstorms which seemed to form a crust over the soil and hinder germination. The most common disease was apparently the root rot caused by Aphanomyces euteiches. No cultures were made but the yellowing of the vines and the readily sloughed-off cortex of the root were characteristic. Possibly one-fourth of the fields visited showed the root rot but the average loss was no more than 5 per cent.

A few scattered plants were found that seemed to be affected with the Fusarium wilt. This disease apparently is rather rare under average New York State conditions.

The downy mildew, Peronospora viciae, was very abundant on the lower leaves in one large field in Livingston County. It was interesting to note that ten years ago this fungus was found abundantly in a field near this location. Downy mildew has not been found to any extent in any other fields, either during the present survey or during past ones.

A bacterial disease apparently caused by Bacterium pisi was present in Yates County and specimens were brought in from Oswego County. All the lower leaves showed angular to circular spots, sometimes diffused over a large part of the leaf area, and more or less transparent in the center in some cases. No loss was observed but it is possible that if the season remains favorable to the growth of the organism considerable injury may result from the early infections.

POTATO DISEASES IN FLORIDA IN 1931

Reported by C. M. Tucker

This final report on potato diseases in Florida in 1931 includes the results of surveys in the large Hastings and La Crosse sections and scattered plantings along the East Coast to the large area in the Homestead section.

Late blight (Phytophthora infestans) was generally distributed and caused a loss estimated at 2 per cent. Rainy periods in April and temperatures below normal were favorable to its spread.

Abundant moisture during January and mean weekly temperatures of from 2° to 6° below normal were very favorable to the development of Rhizoctonia solani, which was much more prevalent than usual. A loss of 7 per cent was estimated from comparative yield figures of trial plats with known percentages of infection. Greatest injury occurred early in the season. Green Mountain showed resistance, while Bliss Triumph, Irish Cobbler, and Spaulding Rose were susceptible.

Brown rot (Bacterium solanacearum) occurred in the La Crosse area late in the season. It is usually very important but was less prevalent this year. Fields known to be infected are not planted. The loss was estimated at 1 per cent reduction in yield and an additional 1 per cent loss from rot. All varieties were susceptible, but Green Mountain was distinctly less so than Bliss Triumph, Irish Cobbler, and Spaulding Rose.

Scab (Actinomyces scabies) is a limiting factor in southern Florida in muck soil, but is not important in the acid soils of the main potato areas. The loss was only a trace.

Southern wilt (Sclerotium rolfsii) occurred locally in low wet spots, causing a trace of loss. Maturing stems were killed but no tuber infection was observed. Early blight (Alternaria solani) and black leg (Bacillus phytophthorus) were general but of slight importance, the loss from each being only a trace.

Virus diseases. No virus disease caused a total loss of more than a trace. Green Mountain and Bliss Triumph are very susceptible to mild mosaic, but neither is grown on a very large scale as compared with Spaulding Rose, which is immune. Rugose mosaic is found occasionally in fields of all three varieties. Leafroll infection averaged about 2.1 per cent in Spaulding Rose potatoes from Maine certified seed, but was not seen in Green Mountain. A few cases of spindle tuber were noted in Spaulding Rose.

OTHER REPORTS ON POTATO DISEASES

Rhizoctonia (Corticium vagum) in Massachusetts: On June 4 I observed an unusually heavy infection of Rhizoctonia in a 60-acre planting of Green Mountains in Hampden County. The seed was certified but not treated, planted early. The surface of the old seed pieces indicated heavy scurf. Damage was greater in fields planted from April 1 to 15 than in those planted later, but was of marked importance in all. At present there are about 20 per cent skips due to early rotting off of the sprouts and 20 per cent late hills from secondary sprouts. (O. C. Boyd, June 9.)

Scab (Actinomyces scabies) and Rhizoctonia in Arizona: For several years the New Zealand treatment has been applied to seed potatoes in the Duncan district. This year's crop from treated seed is clean at the present time. (J. G. Brown, June 13.)

Virus diseases in Arizona: Fields in the Duncan district show a striking contrast between crops raised from certified seed and local seed from rogued fields as compared with crops from ordinary seed. Virus diseases, including rugose mosaic, leafroll, mild mosaic and curly dwarf are almost absent from the former; Leafroll is bad and the other mentioned forms of mosaic present in the latter. Certified seed from high altitudes is making a poorer showing in growth than local seed from rogued fields. (J. G. Brown, June 13.)

REPORTS ON TOMATO DISEASES

MASSACHUSETTS: Bacterial canker (Aplanobacter michiganense) observed March 20 causing seed decay and blighting of seedlings in flats under glass; seed known to be infected. Wilt (Verticillium alboatrum) observed March 11 in plants which had been set in greenhouse two weeks. Heavy infection and considerable loss had developed in the same planting by May 26. (O. C. Boyd, June 9.)

TEXAS: Bacterial canker is very common in all tomato-growing sections, attacking particularly the stems, causing cankers and in many cases girdling branches or the foot of the plant. Early blight (Alternaria solani) is very commonly distributed in nearly all fields in east, east central, and south central Texas; about 1 per cent loss. Southern blight (Sclerotium rolfsii) is common in East Texas, girdling the foot of the plants. Loss 0.5 per cent. Blossom end rot (non-par.) is very common and has caused about 5 per cent loss of the fruit in the first clusters of Marglobe tomatoes grown in east central Texas. (J. J. Taubenhaus, June 11.)

FRUIT DISEASES

THE STRAWBERRY DISEASE SITUATION IN LOUISIANA DURING THE 1931 BERRY SEASON

Reported by A. G. Plakidas

This year Louisiana had a record strawberry crop both in quantity and quality. It was the largest berry crop ever produced in the state, yielding a return of $9,700,000, and it was of excellent quality. Exceptionally favorable weather conditions, both during the growing and the picking seasons, were responsible for this remarkable crop. The winter months were uniformly cool -- not too cold to check the growth of the plants and not warm enough to force premature blossoming. There was sufficient but not excessive rainfall so there was no water-logging of the roots. Then, the picking season was uniformly cool and relatively dry, favorable to an even ripening of the fruit and unfavorable to fruit rots. These favorable conditions were probably responsible for the relatively small losses caused by diseases this year. With the exception of the leaf spots, the damage caused by diseases was slight. The disease situation may be summarized thus:

1. Leaf spot (Mycosphaerella fragariae): Leaf spot infection was general and very severe in the unsprayed fields in the southern part of Tangipahoa parish. In a spray test, the sprayed plat (sprayed with 4-4-50 Bordeaux every 10 days from January 2 to March 13) gave a 170 per cent increase in yield over the unsprayed check. In the northern part of the berry section, leaf spot infection was less severe. For the entire section the loss caused by leaf spot amounted to 20 to 30 per cent.

2. Scorch (Diplocarpon earliana): It is rather difficult to separate the damage caused by the scorch from that caused by the leaf spot since the two diseases often occur together on the same plant. On the whole, although scorch infection was general, the damage caused by it was decidedly less than that caused by the leaf spot.

3. Crown rot (Sclerotinia sclerotiorum): (1) On plants -- Local, light infection, damage very slight. (2) On berries -- (See below under berry rots).

4. Dwarf (Aphelenchus fragariae): Practically entirely absent, probably due to the persistent cold winter and cool spring months. Dwarf symptoms did not begin to appear in the field until the first week in June, that is, until the berry season was completely over. Damage very slight.

5. Root-rot-growth-failure: Strawberries were practically free from root troubles this year. This was probably due to the most favorable weather conditions prevailing during the growing season -- no extreme temperatures and sufficient, but not excessive, rainfall.

6. Berry Rots: Losses from berry rots relatively insignificant, probably not over 0.5 per cent, due to the cool, dry weather which prevailed during the picking season.

Examination of a large number of rotting berries collected at different times from different packing sheds showed the following distribution among the different types of rots:

Gray mold (Botrytis sp.)	60.0 per cent
Hard brown rot (Rhizoctonia sp.)	10.7 " "
*Watery rot (Sclerotinia sclerotiorum?)	21.4 " "
Tan brown rot (Pezizella lythri)	5.6 " "
Others (Phytophthora and undetermined)	2.3 " "

The watery rot was observed for the first time on strawberries in Louisiana. The fungus responsible for this type of rot is probably S. sclerotiorum, although the sclerotia were smaller than those usually formed by this species.

APPLE SCAB (VENTURIA INAEQUALIS) IN MASSACHUSETTS

"The weather has been unusually favorable for scab development this year. Infection periods occurred on May 2, 8 to 10, 13 to 14, 23, 31, and June 7 to 8, corresponding to the following stages of bud, flower, or fruit (in McIntosh): pre-pink, pink, full blossom, calyx or petal fall, and first cover spray. Considerable infection occurred on May 2 and 8 to 10, when early and late orchards, respectively, were in the pink bud stage. The first report of scab on new leaves was May 18 from Hampshire and Plymouth Counties, on Baldwin and McIntosh. Scab could be found in all early and moderately early orchards at that time. Winter spores

were mature and shooting in traps by the time most orchards were in the early to full pink stage. With long wet pink and blossom periods, and frequent rains since, scab has an unusual start." (O. C. Boyd, June 9.)

Notes on scab development in other states would be appreciated.

FRUIT DISEASES REPORTED FROM ARIZONA

The following notes were sent in by J. G. Brown.

PEAR: Blight (Bacillus amylovorus). Five acres of orchard in Pima County near Tucson badly infected. According to owner some trees are beyond recovery. Material brought to the laboratory showed dead branches and leaves due to blight.

A trace of blight was found in several orchards in Oak Creek Valley, Yavapai and Coconino Counties, April 13 to 18. Two old apple trees showed extensive injury below the crown on the larger roots. The blight bacillus was isolated from one of the trees, in pure culture. (June 11)

APPLE: Dieback and canker (Cytospora rubescens). Prevalent in Oak Creek Canyon where it sometimes follows winter injury. (June 1)

Powdery mildew (Oidium sp.) is more or less common in orchards in Oak Creek Valley. One orchard is badly attacked. Several growers control the disease successfully with lime-sulfur spray. (April 16)

Blight. See pear.

PLUM: Crowngall (Bacterium tumefaciens). Over 200 trees were killed in two orchards near Mesa, Maricopa County. The greatest mortality occurs when the fruit of affected trees is maturing. (May 23)

PECAN: Crowngall (Bacterium tumefaciens) sent in from bearing orchard at Chandler. (June 8)

MULBERRY DISEASES

Bacterial blight (Bacterium mori) in Texas. This disease is very common, causing the tips of the twigs to blight and in many cases also affecting the leaves and resulting in numerous round, transparent, water-soaked spots. (Taubenhaus, June 11).

Popcorn disease (Sclerotinia carunculoides) on red mulberry in North Carolina. A specimen was received June 23 from W. A. Thomas, collected at Chadbourn. The tree from which the fruit came is said to be about fifteen years old. No sign of the popcorn disease was noticed until four years ago.

DISEASES OF CEREAL AND FORAGE CROPS

WHEAT DISEASES IN FAIRFAX COUNTY, VIRGINIA

Dr. R. J. Haskell contributes the following report.

> "In company with County Agent Derr, I visited 8 wheat fields in Fairfax County on June 15. Owing to the prospect for low wheat prices and on account of the shortage of hay due to last year's drought, a considerable portion of the wheat is being cut for hay and a large amount of that which will be threshed will be ground up for feed. In general the fields were looking well with good yields in prospect. The two principal troubles with wheat as I observed them, were, first, the smut diseases, particularly stinking smut (Tilletia laevis), and second, admixture of rye and other varieties of wheat. In the 8 fields that we inspected stinking smut was present in 5. The average loss in yield in the 8 fields on account of stinking smut was about 2 per cent. One field had 7 per cent and another 5 per cent loss on account of it. The nematode disease (Tylenchus tritici) was observed in one field. A slight amount of loose smut (Ustilago tritici) was in general causing a loss of less than 1 per cent. Leaf rust (Puccinia triticina), powdery mildew (Erysiphe graminis), scab (Gibberella saubinetii), and glume blotch (Septoria nodorum) were observed frequently but apparently were not causing much, if any, damage."

OTHER NOTES ON DISEASES OF CEREAL AND FORAGE CROPS

OATS: Loose smut (Ustilago avenae) in Texas. Has caused considerable loss this year, estimated at about 10 per cent. (Taubenhaus, June 11).

SWEET CORN: Wilt (Aplanobacter stewartii). Specimen from Fairfax County, Virginia, received from R. J. Haskell, June 17. Determination verified by A. G. Johnson. In a small garden plot 25 per cent of the plants were dying while only about two feet high. The grower thinks the variety is Golden Bantam.

WHEAT: Basal glume rot (Bacterium atrofaciens). V. H. Young sent specimens collected June 6, from Arkansas, with the remark that there was considerable of the trouble on the wheat in the experimental plots at the University Farm. The determination was verified by A. G. Johnson.

Glume blotch (Septoria nodorum (S. glumarum)) Specimens from Fairfax County, Virginia, R. J. Haskell, June 15. Determination verified by A. G. Johnson. All the plants showed crinkle joint, which, according to Dr. Johnson, aids infection by the Septoria by bending the stalks over and bringing the heads down to moist air near the earth.

ALFALFA: Bacterial blight (Bacterium medicaginis) in Arizona. Evidence that infection was heavy in the early cuttings of alfalfa in the Duncan district is shown by the large number of blackened stalks in the stubble. Occasional green stems are infected at the present time. (J. G. Brown, June 13).

DISEASES OF ORNAMENTALS AND TREES

ORNAMENTALS

CARNATION: Rust (Uromyces caryophyllinus). Approximately 15 per cent of plants in one greenhouse at Flagstaff, Coconino County, Arizona. (J. G. Brown, May 21).

COREOPSIS: Root rot (Rhizoctonia sp.) has attacked a large number of coreopsis and snapdragons in flower gardens in south and south-central Texas. It causes wilting and rapid dying of full-grown plants (J. J. Taubenhaus, June 11).

DELPHINIUM: Black spot (Bacterium delphinii) from Berkshire County, Massachusetts, May 24. (O. C. Boyd, June 9.)

Smut (Urocystis sorosporioides Körn.) on D. tricorne. Specimen from wild flower garden at Lexington, Kentucky, May 15, 1931, W. D. Valleau.

GERANIUM: Bacterial spot (Bacterium pelargoni). Specimen from Fostoria, Seneca County, Ohio, collected by E. W. Mendenhall, May 20. Determined by Lucia McCulloch.

ROSE: Powdery mildew (Sphaerotheca pannosa) is very common on roses everywhere in Texas this year, weakening the plants and preventing many buds from opening. (Taubenhaus, June 11.)

SNAPDRAGON: Root rot. See Coreopsis.

SWEET PEA: Streak (Bacillus lathyri) is showing up on mature plants in Texas, in many cases killing out entire plantings. (Taubenhaus, June 11.)

ANTHRACNOSE DISEASES OF TREES

A number of reports have been received of anthracnose fungi attacking various trees.

ASH: Gloeosporium aridum. Massachusetts. Specimens from Springfield and from Essex County received from O. C. Boyd. Det. J. A. Stevenson. Specimen from Millis, Norfolk County, collected by H. H. Richardson, det. D. P. Limber.

ELM: Gnomonia ulmea. Very common in Texas this spring on American and Chinese elms, causing leafspot and particularly twig blight. (Taubenhaus, June 11.)

LINDEN: Gloeosporium sp. Brookville, Massachusetts, June 5. (Boyd, June 9.)

MAPLE: Gloeosporium sp. on cut-leaf maple, Hampden County, Massachusetts. (Boyd, June 9.)

OAK: Gnomonia veneta on white oak, Massachusetts. (Boyd).

WILLOW SCAB IN MASSACHUSETTS

"Willow scab (Fusicladium saliciperdum) is prevalent as usual on the college grounds and in nearby places. It was first observed May 4 in Hampshire County. It continues to spread on the infected trees. In one area counted, 18 per cent of the leaves were infected.

"There is evidence of variation in susceptibility among the different willows." (W. H. Davis and O. C. Boyd, June 9.)

TOBACCO DISEASE SURVEY

REPORTS OF SEED BED SURVEYS

WEST VIRGINIA, MAY 18 to 21

C. R. Orton

Ineffective methods of burning are in vogue in these districts. Growers all complain of the work necessary to get together sufficient wood to burn the beds properly. Not more than half of the beds are burned long enough to kill weed seeds and the fungi which may be present. We shall give this matter further publicity prior to the preparation of the seed beds next year.

Ring spot (virus)was found on a very few plants in one seed bed in Mason County.

Black root rot (Thielavia basicola) was found in three beds in Wayne and Putnam counties. In one of these cases three-fourths of the seed bed was infected, but in one end of the bed, involving about one-fourth of the area, where the "firing" was completed and burning lasted for about three hours the plants were all healthy. It was an excellent demonstration of the importance of burning the beds for a longer period than many of the growers practice.

In several beds located along the Ohio River frost injury was quite apparent. This was manifested by a "pinching" of one of the younger leaves. In most cases the injury was not severe enough to cause necrosis and probably will not be of commercial importance in the production of plants sufficient for setting the fields.

In three beds, one each in Cabell, Wayne, and Putnam counties, a mild mottling was found which showed on the older leaves. It was very suggestive of the mild mosaic on potatoes. In the Cabell County bed about 50 per cent of the plants showed this mottling, in the Putnam County bed about 25 per cent, and only a very few plants in the one in Wayne County. Specimens were taken and sent to the laboratory at Morgantown for testing a possible virus on young Burley tobacco. The juice was expressed from the plants and scratched into healthy young Burley plants. Three weeks later no mottling had appeared and the conclusion is reached that the field symptoms were probably induced by some unfavorable soil condition.

There was evidence in a few beds that damping-off had been present but none of the growers interviewed recognized this disease when it was active.

One of the most outstanding features of the survey during the two years was the absence of leaf spots, both bacterial and fungous.

I wish to acknowledge the hearty cooperation of W. D. Click, County Agent, Cabell County, and Claude Strothers, County Agent, Wayne County, who gave their time in visiting the seed beds in their districts with me.

OHIO, MAY 18 to 23

A. L. Pierstorff

The tobacco growing industry of Ohio is divided into two distinct areas with a different type of tobacco being grown in each. In the section centering around Adams and Brown counties the Burley type of tobacco is grown almost exclusively while in the region centering around Montgomery, Preble, Miami, and Darke counties the dark type of tobacco, (Spanish, Dutch, etc.) predominates.

The seed used was, invariably, growers' own selected, one-year old seed. It usually was not cleaned before being planted and it gave good germination.

In the Adams and Brown county region, burning is usually practiced for soil sterilization. No diseases of any kind were present in epidemic form.

In the Montgomery, Preble, Miami, and Darke county area about 34 per cent of the beds showed some, often only a trace, of damping-off even though 97 per cent of the beds were steamed at 100 pounds pressure for 15 to 25 minutes. Under those conditions it is quite evident that steaming did not solve the problem entirely, because in many cases the pans do not fit the width of the bed and contaminated soil is mixed with the steamed soil.

In a letter accompanying his report, Mr. Pierstorff remarks,

> "There is a scarcity of diseases, especially bacterial leaf spot, which I attribute primarily to last year's drouth. In about 1925 and 1926 there was a severe outbreak of wildfire (Bacterium tabacum) in southeastern Ohio, but for the last few years we have seen very little evidence of this disease."

DOWNY MILDEW OF TOBACCO IN SOUTHERN MARYLAND

According to W. B. Posey, Tobacco Specialist for Maryland and County Agent of Prince George County, and P. E. Clark, Assistant County Agent, the tobacco downy mildew (Peronospora hyoscyami) has apparently occurred in seed beds throughout the southern Maryland area, but was checked by the recent hot weather. It did not appear until most of the plants had been set in the field and does not seem to be causing any damage at the present time. (J. E. McMurtrey, Jr., Associate Physiologist, Division of Tobacco and Plant Nutrition, June 25.)

MARKET PATHOLOGY

NEW YORK MARKET PATHOLOGY NOTES

DECAY OF SWEET CHERRIES FROM CALIFORNIA

By Cyril O. Bratley

In the inspection of sweet cherry shipments from California during the month of June many fruits were found which showed small rotted areas each covered with a small tuft of white mycelium. In most cases the decay followed skin punctures. Those who handle cherries on the market have been considering the decay Gray Mold Rot (Botrytis sp.). However, the scantiness of the mycelium and the slowness of development caused doubts as to the accuracy of this diagnosis. In two shipments examined about 3 per cent of the cherries showed decay of which one-half exhibited the confined white tufts.

Cultures from this type of decay consistently yielded a species of Cladosporium. Inoculation experiments proved the fungus to be definitely pathogenic. The pathogenicity of several other fungi isolated from diseased cherries was tested in a similar manner and a comparative study made of the decays produced by the following fungi: Cladosporium sp., Sclerotinia fructicola, Rhizopus sp., Penicillium sp., Botrytis sp., and Aspergillus sp.

The decay caused by the Cladosporium developed slowly. At the end of three days the spots were about 2 mm. in diameter and showed the characteristic small white tufts of aerial mycelium. In six days after inoculation the areas were approximately 5 mm. in diameter and the mycelium covering the lesions had turned olive green with the production of spores. The rot is tan color, cone shaped, firmer than the other decays and, like Alternaria Rot (Alternaria sp.), can be lifted out intact from the healthy tissue. It differs from Alternaria Rot, however, in the fact that the decayed area is lighter in color, firmer in consistency and the aerial mycelium less extensive. Cladosporium Rot develops at a slower rate than Alternaria Rot. Secondary organisms, particularly species of Penicillium, often gain entrance through the slowly enlarging decayed area and rapidly destroy all of the symptoms of the initial disease.

Brown Rot (Sclerotinia fructicola) was found to be responsible for the greatest part of the loss in shipments examined during the month.

Alternaria Rot (Alternaria sp.) was second to Brown Rot in frequency of occurrence. The extensive olive green growth of sporulating mycelium covering the decayed area and the cone shaped, easily removed necrotic tissue are its distinguishing characteristics. A few specimens were found in which the olive green mycelium covered large areas on the cherry with little or no penetration below the epidermis of the fruit. Different isolations of the causal fungus behaved differently on artificial culture media and when inocu-

lated into fruit had different rates of development. Apparently several strains or possibly more than one species of the fungus are involved.

In certain shipments Rhizopus Rot (Rhizopus sp.) was very common. The coarse mycelium, white at first, later gray black to black, the large terminal sporangia and the total collapse of the affected fruit characterize the decay.

Blue Mold Rot (Penicillium sp.) following skin breaks was found to be as prevalent as the Cladosporium Rot. The affected tissue is as soft and watery as Rhizopus Rot but the superficial mold is scanty and early turns the characteristic bluish green.

An occasional specimen of Gray Mold Rot (Botrytis sp.) was found. The decayed area is softer and more watery than that of Brown Rot but much less so than that of Rhizopus Rot. The skin covering the lesion slips easily under pressure while in Brown Rot the skin clings to the decayed tissue. Under the humid conditions of the cherry shipping lug an extensive very fluffy greyish mycelial growth is produced. The aerial growth is more extensive than that of any other cherry rotting fungus observed except Rhizopus and can be easily distinguished from the latter by the fineness of the hyphae.

A species of Aspergillus was isolated several times from specimens of decaying cherries. When artificially inoculated into fruit it produces a watery and mushy rot that can be scooped out leaving a clean hollow in the surrounding healthy tissue. The fungus fruits sparingly through the breaks in the skin on the surface of the lesion.